DYWIDAG-SYSTEMS INTERNATIONAL

Service, Accessories and Equipment

ALWAG SYSTEMS

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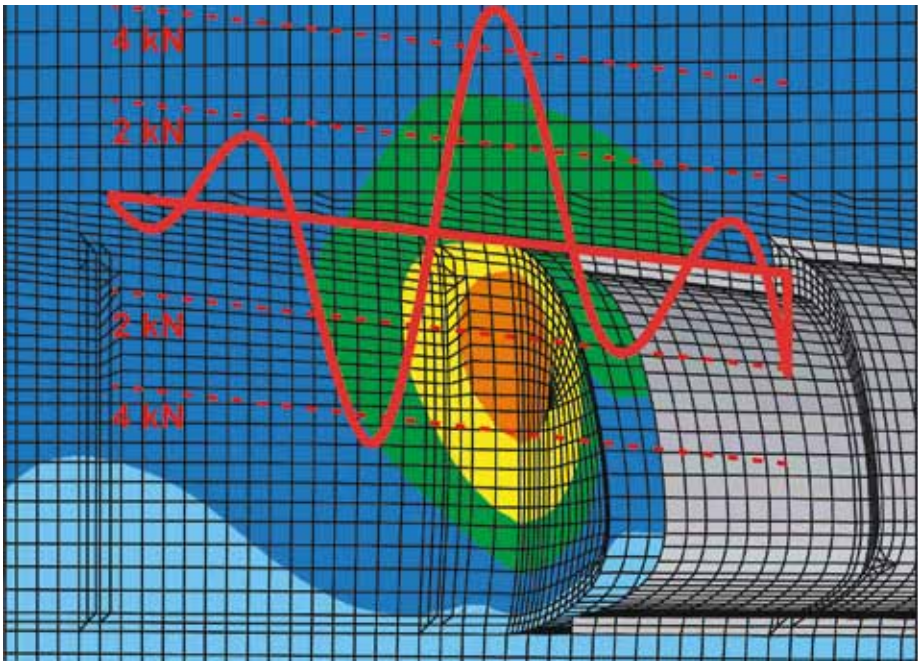
Introduction

DYWIDAG-Systems International (DSI) provides its customers with a large variety of ground control systems for Mining and Tunneling as well as with competent technical service, equipment and accessories for the installation and application of rock reinforcement and rock support elements.

Technical Service

A DSI team of experienced technicians and supervisors provides technical support as well as on-site product management. Our service team is available for general and product-specific questions in the following areas:

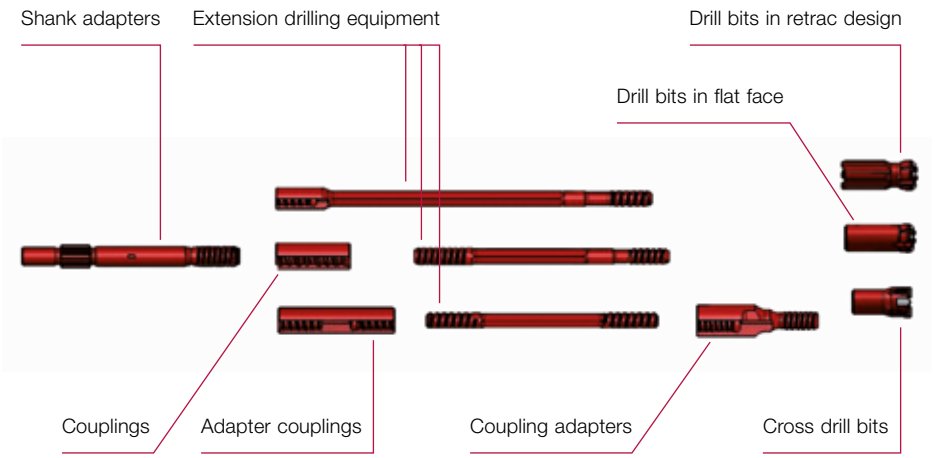
- Design, testing, and evaluation of rock bolt systems
- Self-Drilling reinforcement technology
- Layout and optimization of lattice girder support
- Pipe umbrella support and drainage drilling works
- Accomplishment and monitoring of injection works
- Testing of product usage properties



Rock Drilling Equipment

Fields of Application

- Blasthole drilling
- Production drilling
- Extension drilling
- Overburden drilling
- Pre-Drilling



System Components

- Shank adapters
- Couplings
- Adapter couplings
- Extension drilling equipment
- Coupling adapters
- Drill bits
  - Drill bits in either flat face or retrac design
  - Cross drill bits
- Pre-Drilling bits for the AT-SYSTEM
- Various adapters and driver tools for rock bolts
- Individual drill bits available on request

Order Information

Article Description	Available Thread Types [2]	Required Information [3]
Shank adapters	R32, R38, R51, T32, T38, T51	Thread (connecting thread type; version M or F), rock drill type, length [mm] [1, 3]
Couplings	R32, R38, R51, T32, T38, T51	Thread (connecting thread type)
Coupling adapters F/F [1]	R32, R38, R51, T32, T38, T51	Thread (connecting thread type A and B)
Extension rods M/F [1]	R32, R38, R51, T32, T38, T51	Thread (type connecting thread); length [mm] [3]
Extension rods M/M [1]	R32, R38, R51, T32, T38, T51	Thread (type connecting thread); length [mm] [3]
Adapter M/F [1]	R32, R38, R51, T32, T38, T51	Thread (connecting thread type A and B)
Adapter M/M [1]	R32, R38, R51, T32, T38, T51	Thread (connecting thread type A and B)
Button drill bits version flat face	R32, R38, R51, T38, T51	Thread (connecting thread type), drill bit diameter
Button drill bits version retrac	R32, R38, R51, T38, T51	Thread (connecting thread type), drill bit diameter
Cross drill bits	R32, R38, R51, T38, T51	Thread (connecting thread type), drill bit diameter
Pre drill bits	R32, R38, R51, T38, T51	Thread (type connecting thread), drill bit diameter
Driver tools	R32, R38	Rock bolt type, thread (type connecting thread)

1) ”F” ... female (inner) thread; ”M” ... male (outer) thread
2) Special thread types available on request
3) Special lengths available on request

OMEGA-BOLT® High-Pressure Pump

Introduction

OMEGA-BOLT® Expandable Rock Bolts are preferably installed using the electrical type 300E high-pressure pump. This compact high-performance pump with an 11 [kW] electric motor is designed for a maximum working pressure of 300 [bar].

The maximum inflation pressure is adjusted by a spring pressure gauge; additionally, a pressure limiting valve prevents overload. The regulation is effected by a combination switch on/off and emergency shutdown, respectively. Protection against dry running ensures a secure operation of the low-noise and low-vibration high-pressure aggregate.

Main Advantages

- Tough design and easy handling
- Fast installation due to high pump performance
- An optimum expansion of the OMEGA-BOLT® Expandable Friction Bolt is ensured

Accessories

- Setting arm
- Setting head
  - Type EFB-120 or EFB-160/240
- High-pressure hoses in different lengths available
- Spare parts available on request
- Alternative high-pressure pumps available on request
- OMEGA-BOLT® pull testing equipment available on request

System Description

The installation equipment for the OMEGA-BOLT® Expandable Rock Bolt consists of the following components:

- OMEGA-BOLT® high-pressure pump 300E (water pump and electric motor)
- High-pressure hose
- Setting arm with setting head

After insertion of the OMEGA-BOLT® Expandable Rock Bolt into the borehole, the setting arm is fitted to the bolt's head. By operating the valve lever on the setting arm, the bolt is hydraulically expanded (unfolded) using high-pressure water, which is induced into the inside of the folded bolt tube. After reaching the defined maximum setting pressure, the valve lever is released and the setting head is pulled away from the bolt's head.

Further References

- Brochure OMEGA-BOLT® Expandable Friction Bolt
- Operating manual OMEGA-BOLT® High-Pressure Pump Type 300E
- Spare parts list OMEGA-BOLT® High-Pressure Pump Type 300E

Specifications

Characteristics	Unit	Value
Dimensions (L x W x H)	[mm]	800 x 400 x 455
Weight	[kg]	90
Max. flow rate	[l/min]	21
Operating pressure [1)]	[bar]	300
Max. operating pressure	[bar]	320
Power supply	[V]	3 ~ 400
Nominal power	[kW]	11
Electrical connection	[A]	25
Pumping rotation speed	[rpm]	1,400

1) Required tube connection 3/4", water connection pressure: 2 [bar]

Cement Grout

Introduction

In engineering and underground construction, cement grout is required for establishing a force and form fit bond between a supporting member and the foundation soil or rock mass.

Depending on the application or the supporting member type, cement grout is applied either before or after the installation using an injection hose. Mixing and transport of cement grout are carried out using mortar-mixing pumps, which are constructed specifically for the requirements in the construction industry.

In contrast to customary products, cement grout features both an excellent overhead workability as well as early strength.

System Description

- Hydraulically bonded cement grout
- Portland cement with high quality mineral additives
- Bonding medium for cement grout embedded anchors and rock bolts

Fields of Application

- Grouting of rock bolts in Mining and Tunneling
- Pressure grouting of anchors and soil nails
- Rock and foundation soil consolidation
- Injection works with high demands regarding early strength

Main Advantages

- Universally applicable
- Increased early strength
- Thixotrope – excellent overhead workability
- Swellable
- Frost-proof XF3

Specifications

- Mixing liquid: water
- Shelf life in dry conditions: 6 months
- Packaging: paper bag of 25 [kg] or bigbags of up to 1,000 [kg]

Characteristics [1]	Unit	Value
Yield	[kg/L]	ca. 1.6
Bulk density	[kg/dm^3]	ca. 1.4
Granulation	[mm]	0.8
Liquid requirement	[ml/kg]	ca. 205 - 220
Mixing time	[min]	ca. 1.5 - 3.0
Processing time	[min]	ca. 30
Swelling	[%]	ca. 0.5 - 1.0
UCS after 1 day	[N/mm^2]	ca. 30
UCS after 7 days	[N/mm^2]	ca. 45
UCS after 28 days	[N/mm^2]	ca. 55
Bending tensile strength after 28 days	[N/mm^2]	ca. 9.0

1) The indicated values are laboratory values and may deviate on-site

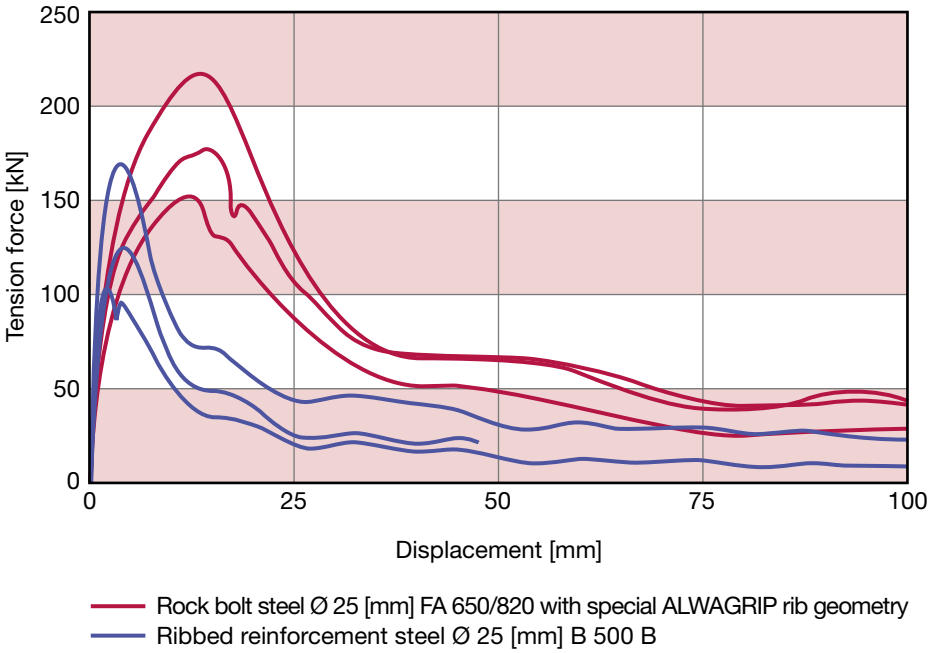
Cement Grout

Mixing and Processing

- For pre-mixing, a compulsory mixer or a high quality continuous mixer is recommended
- After curing, immediate processing is advantageous due to thixotropic stiffening
- When the cement grout begins to stiffen, it must not be mixed up with water by any means

Technical Features

- Tested in combination with SN-Anchors with special ALWAGRIP rib geometry (see load-displacement diagram)
  - Specific rib area between 0.02 and 0.04 (cf. RVS 8T, Federal Ministry for Transport, Innovation and Technology, Austria)
- Examination of the inner bond of two different anchor steel types, depending on curing times
- Results of pull-out tests after 12 hours curing time with a bond length of 500 [mm]



Accessories

- Mortar-Mixing pumps
- Injection adapters
- Flushing heads

Further References

In general, the common basic principles of concrete technology as well as the relevant standards and guidelines must be observed. This brochure gives only general information based on internal experience and examination under standard conditions at the time of pressure application, and does not consider individual applications.

According to external circumstances – especially the foundation soil, nature of processing, and environmental conditions – results can deviate from the indications presented.

- Blümel, M.; Schweiger, H.F.; Golser, H.: Effect of Rib Geometry on the Mechanical Behaviour of Grouted Rock Bolts, World Tunnel Congress ´97, 23rd General Assembly of the International Tunnelling Ass., Vienna, Austria, 1997
- Payer, M., Maydl, P.: Untersuchungsbericht - Ausziehversuche von SN-Mörtelankern. Auftrags-Nr.: 77.645/08, Prüfdatum: 2008-04-22 - 2008-06-13. Technische Versuchs- und Forschungsanstalt für Festigkeits- und Materialprüfung, Graz University of Technology. Graz, Austria, 2008

Injection Adapters and Flushing Heads

Fields of Application

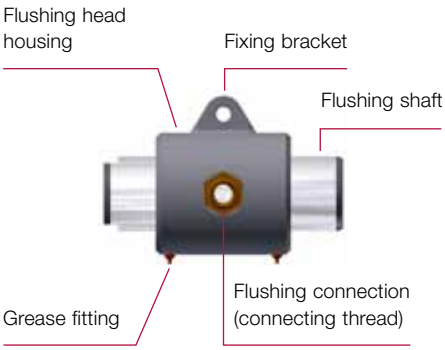
- Injection adapters: subsequent injection following the self-drilling installation of the DYWI® Drill Hollow Bar System
- Flushing heads (rotary injection adapters): drilling and injecting in one operational step

Main Advantages Rotary Injection Adapters

- Simultaneous drilling and injecting ensures an ideal bond with the loose rock or soil
- Penetration of the injection material into the surrounding foundation soil
- Ground improvement and homogenous distribution of the injection material

System Components flushing head

- Flushing head housing
- Flushing shaft with connecting thread for the hollow bar and the shank adapter
- Gasket and wiper (internal)
- Fixing bracket with connection thread for the injection hose
- Grease fitting
- Dampening rubber



Order Information

Description	Article Code	Article No.
Post Injection Adapter, R32/R38	IA-R32-15/22	300060012001
Post Injection Adapter, R51	IA-R51-30/45	300060012002
Rotary Injection Adapter, HEX22M-R32F-045	RIA-HEX22M-R32F-LI	301061221045
Rotary Injection Adapter, XDDD-R32-080 [1)]	RIA-XDDD-R32-080-LI [1)]	301060021080
Rotary Injection Adapter, XDDD-R38-080 [1)]	RIA-XDDD-R38-080-LI [1)]	302060021080
Rotary Injection Adapter, XDDD-R38-085 [1)]	RIA-XDDD-R38-085-LI [1)]	302060021085
Rotary Injection Adapter, XDDD-R51-085 [1)]	RIA-XDDD-R51-085-LI [1)]	303060021085
Rotary Injection Adapter, XDDD-R51-110 [1)]	RIA-XDDD-R51-110-LI [1)]	303060021110
Rotary Injection Adapter, XDDD-R51-140 [1)]	RIA-XDDD-R51-140-LI [1)]	303060021140
Rotary Injection Adapter, XDDD-T76-110 [1)]	RIA-XDDD-T76-110-LI [1)]	304060021110
Rotary Injection Adapter, XDDD-T76-140 [1)]	RIA-XDDD-T76-140-LI [1)]	304060021140
Flushing Shaft Type RIA, R32F-R32F	FS-RIA-R32F-R32F-080	301060142080
Flushing Shaft Type RIA, R38F-R32F	FS-RIA-R38F-R32F-080	301060242080
Flushing Shaft Type RIA, T38F-R32F	FS-RIA-T38F-R32F-080	301060442080
Flushing Shaft Type RIA, T45F-R32F	FS-RIA-T45F-R32F-080	301060542080
Flushing Shaft Type RIA, R38F-R38F	FS-RIA-R38F-R38F-080	302060241080
Flushing Shaft Type RIA, R51F-R38F	FS-RIA-R51F-R38F-085	302060341085
Flushing Shaft Type RIA, T38F-R38F	FS-RIA-T38F-R38F-080	302060442080
Flushing Shaft Type RIA, T45F-R38F	FS-RIA-T45F-R38F-080	302060542080
Flushing Shaft Type RIA, H55F-R38F	FS-RIA-H55F-R38F-085	302060641085
Flushing Shaft Type RIA, T51F-R38F	FS-RIA-T51F-R38F-085	302061041085
Flushing Shaft Type RIA, R51F-R51F	FS-RIA-R51F-R51F-085	303060341085
Flushing Shaft Type RIA, H55F-R51F	FS-RIA-H55F-R51F-085	303060641085
Flushing Shaft Type RIA, T51F-R51F	FS-RIA-T51F-R51F-085	303061041085
Flushing Shaft Type RIA, H64F-R51F	FS-RIA-H64F-R51F-110	303060741110
Flushing Shaft Type RIA, C64F-R51F	FS-RIA-C64F-R51F-110	303060841110
Flushing Shaft Type RIA, H90F-R51F	FS-RIA-H90F-R51F-140	303060941140
Flushing Shaft Type RIA, H92F-R51F	FS-RIA-H92F-R51F-140	303061141140
Flushing Shaft Type RIA, RT70F-R51F	FS-RIA-RT70F-R51F-140	303061241140
Flushing Shaft Type RIA, H64F-T76F	FS-RIA-H64F-T76F-110	304060741110
Flushing Shaft Type RIA, C64F-T76F	FS-RIA-C64F-T76F-110	304060841110
Flushing Shaft Type RIA, H90F-T76F	FS-RIA-H90F-T76F-140	304060941140
Flushing Shaft Type RIA, H92F-T76F	FS-RIA-H92F-T76F-140	304061141140
Flushing Shaft Type RIA, RT70F-T76F	FS-RIA-RT70F-T76F-140	304061241140
Flushing head-080	FH-RIA-080	301060031080
Flushing head-085	FH-RIA-085	301060031085
Flushing head-110	FH-RIA-110	301060031110
Flushing head-140	FH-RIA-140	303060031140
Rotary Injection Adapter, Seal kit head-080	RIA-SK-080	301060051080
Rotary Injection Adapter, Seal kit head-085	RIA-SK-085	301060051085
Rotary Injection Adapter, Seal kit head-110	RIA-SK-110	301060051110
Rotary Injection Adapter, Seal kit head-140	RIA-SK-140	303060051110

1) Consisting of: flushing shaft, flushing head and sealing kit;
X ... connection thread shank adapter (R; T; H; RT; C) / DDD ... inner thread diameter [mm]

Further References

- Brochure DYWI® Drill Hollow Bar System
- User manual DYWI® Drill Hollow Bar System

Mortar-Mixing Pump

Introduction

The electric mortar-mixing pump MP06 is used in underground construction and foundation engineering for filling anchor boreholes and for injection works. To a limited degree, it can also be used for applying shotcrete.

Main Advantages

- Tough design and galvanized pump casing
- Low empty weight
- Simple operation and maintenance due to modular design
- Low start-up and cleaning times
- Low filling and overall height
- High delivery rate at continuous pressure
- Variable discharge
- All-purpose equipment

Specifications

Characteristic Value	Unit	Type MP06
Nominal power	[kW]	5.5
Gear motor	[rpm]	190 1)
Power supply 2)	[V/Hz]	400/50
Electrical connection	[A]	3 x 12 (5 pole)
Min. fuse protection	[A]	3 x 32
Remote control	[–]	Optional (cable or radio)
Spiral pump type	[–]	MP2 to MP20
Max. grain size	[mm]	8
Flow rate 3)	[l/min]	6.3 - 63.3
Max. delivery pressure	[bar]	50
Max. transport distance 3)	[m]	60
Casing length	[mm]	1,000
Total length	[mm]	1,950
Height	[mm]	860
Grid height	[mm]	95
Width	[mm]	650
Weight	[kg]	190
Article No.	[–]	300070011001

1) Rotational speeds from 132 - 290 [rpm] optional
2) Country-specific adaptation possible
3) Depends on the consistency and grain size of the material, the W/C-ratio, spiral pump type, and rotation speed (based on the nominal value)

- Conveyor mixer optionally available
- Required Water pressure 2.5 - 4 [bar]
- Optional pressure control pump
- Further information is included in the operating manual of the mortar-mixing pump MP06

Gunite Pipes

- Wear-resistant steel tubes
- Nominal diameter 50 and 60 [mm]
- Welded-on collars and carbofer couplings
- Length app. 9 [m]
- Accessories and special lengths available on request

Injection Flow-Pressure Meter

Introduction

The injection flow-pressure meter permits an exact and comprehensible documentation of ground improvement as well as a comprehensible control system of the specified injection termination criteria.

System Description

Flow rates and injection pressures are recorded separately for each injection borehole. The manipulation-proof digital data recording is operated via a user-friendly and simple touch-screen terminal. Subsequent to the injection works, the readout of the stored data is carried out via a serial interface as well as a computer-based raw data analysis.

System Components

- Flow meter
- Pressure transmitter
- Operating and analysis unit
- Readout lead
- Tripod
- Technical documentation
- User manual
- Software package

Technical Data Flow Meter and Pressure Tranducer

Component	Charateristics [Unit]	Nominal Value / Description
Casing	Length x width x height [mm]	250 x 430 x 400
	Description stainless steel / material No.	X5CrNi18-10 / 1.4301
	Thread connectors	1" external thread
Transducer	Power supply	max. 24 [V] (DC)
	Plug-in connection to evaluation and operating unit	16-pin (shielded, intrinsically safe wire)
Flow meter	Flow medium	Cement suspension
	Max. flow rate (100%) [m³/h]	3.53
	Max. deviation at 46% or 100% flow rate	0.06 and 0.02
Pressure transducer	Max. pressure [bar]	100
	Deviation measuring range (related to nominal value) [%]	< 0.6

Technical Data Operating and Evaluation Unit

Component	Charateristics [Unit]	Nominal Value / Description
Casing	Length x width x height [mm]	380 x 210 x 600
	Length x width x height incl. stand [mm]	600 x 500 x 1,450
	Description stainless steel / material No.	X5CrNi18-10 / 1.4301
Electric	Connection power with pump	5.7
	Connection power without pump [kW]	0.3
	Power supply	3 x 400 [V] / 50 [Hz]
	Plug-in connection	CEE 5 / 32 [A]
Display screen	Touchscreen	
	Backlighted LCD graphic display with 256 colors	
	Manuel modus (own user interface) or automatic modus	
Control and data processing	Read out and record the plotted data with a data cable to the computer via COM1	

Cable Bolt Tensioner

Introduction

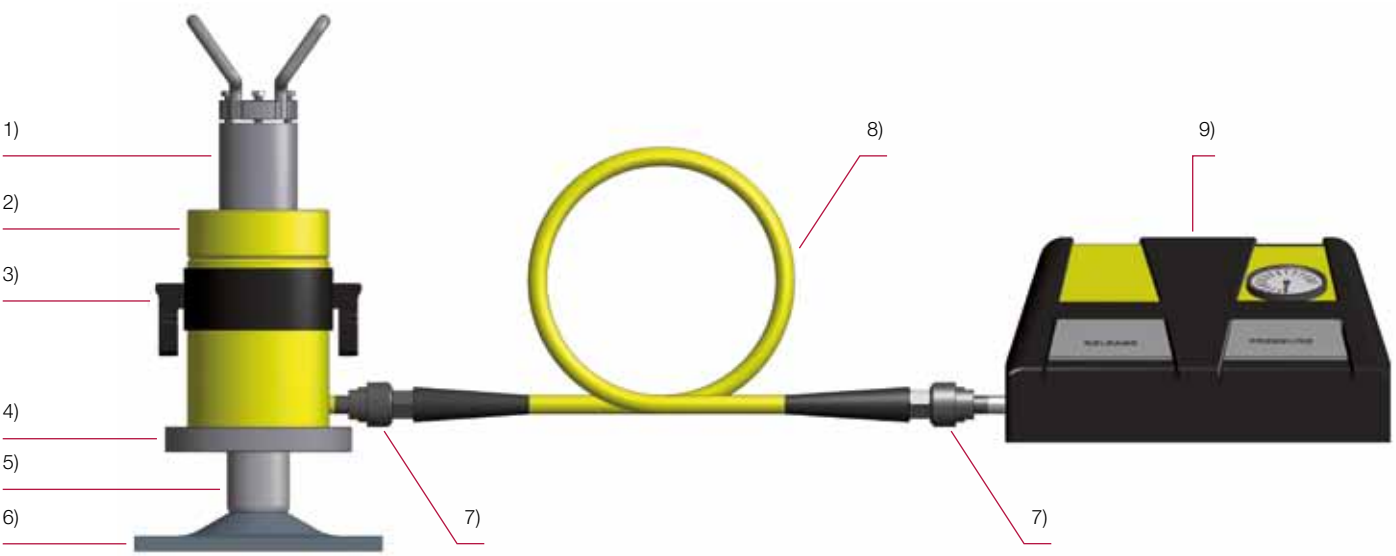
Cable bolt tensioners are used for prestressing or active pre-tensioning Mining cable bolts. These devices for use in underground operations are characterized by low weight, robust construction and user-friendliness. DYWIDAG-Systems International provides different systems of cable bolts, depending on individual applications.

Fields of Application

- Pre-Tensioning of type CB15.3 and Type CB15.7 DYWIDAG Cable Bolts
- Prestressing of cable bolts with free length

System Components

1) Tensioning head
2) Hollow plunger cylinder 320 [kN]
3) Handholds hollow plunger cylinder 320 [kN]
4) Bearing plate
5) Wedge casing
6) Domed plate (schematic)
7) High-flow coupling
8) Hydraulic hose L = 6 [m], incl. 2 high-flow coupling connectors
9) Hydraulic pump with integrated manometer and pressure relief valve



Specifications

- Maximum force: 320 [kN]
- Total weight tensioner head and tensioner: approx. 16 [kg]
- When tensioning or pre-tensioning, the forces that are permitted for the cable bolts in use must be observed

Accessories

- DYWIDAG Cable Bolts
- Hydraulic spare parts
- Tensioning equipment for up to 640 [kN] available on request

Further References

- User manual cable bolt tensioners
- Brochure DYWIDAG Cable Bolts

Pull Testing Equipment

Introduction

Pull testing equipment is required for pull out tests on anchors and rock bolts.

Pull out tests on anchors and rock bolts are performed for supervision of the rock bolting quality. Depending on the type and design of the rock bolt in use, different testing equipment is utilized.

Depending on the operation purpose, modularly designed sets of different pull testing equipment can be adapted to the whole range of rock bolts provided by DYWIDAG-Systems International.

Fields of Application

- Pull out tests
- Supervision of quality criteria of installed rock bolts
- Research and development in the field of ground control technology

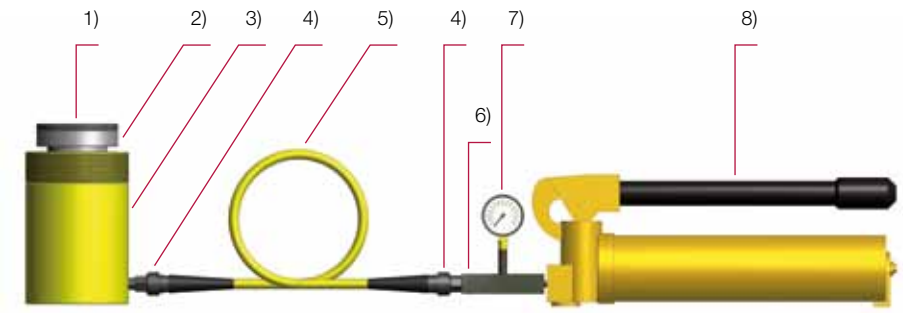
System Components

The pull testing equipment consists of a series of mechanic and hydraulic components and is designed for an ultimate test force of up to approx. 60 [t].

- Hydraulic components
  - Hollow plunger cylinder
  - Hydraulic hose
  - Electric pump or hand pump, with gauge
  - Gauges are provided on demand with a calibration certificate
- Supporting frame
  - Depending on test requirements and test forces, the frame is available either as a tripod or a tubular frame in different sizes
- Mechanic components
  - Intermediate discs
  - Angle compensation plates
  - Balance rods and adapters for rock bolts that are to be tested

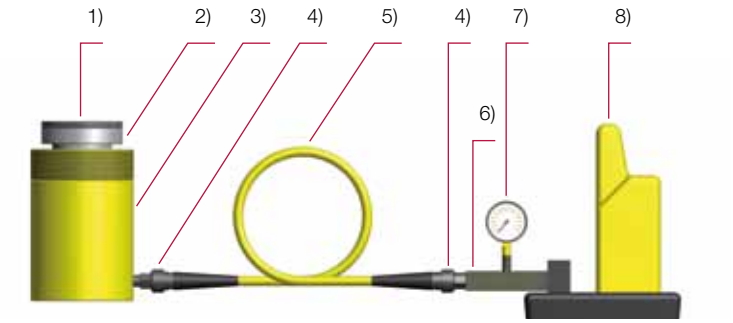
System Components Hand Pump

1) Bearing plate hollow plunger cylinder/nut
2) Thrust piece
3) Hydraluic hollow plunger cylinder, single acting
4) High-flow coupling
5) Hydraulic hose incl. 2 high-flow coupling connectors
6) Manometer piece
7) Manometer (incl. calibration certificate)
8) Hand pump



System Components Electric Pump

1) Bearing plate hollow plunger cylinder/nut
2) Thrust piece
3) Hydraluic hollow plunger cylinder, single acting
4) High-flow coupling
5) Hydraulic hose incl. 2 high-flow coupling connectors
6) Manometer piece
7) Manometer (incl. calibration certificate)
8) Compact electric pump



Order Information

Rock Bolt	Hydraulics [1]		Tripod or Bearing Cylinder [2]		Pull Adapter [3]
	Max. 320 [kN]	Max. 640 [kN]			
GEWI® Mining Anchors	X		X		*GEWI*® coupling, rod, and nut
Mechanical Anchors Type ALWAG	X		X		Pull adapter, washer, and nut [4]
SN-Anchors	X	X	X		Pull adapter, washer, and nut [4]
Resin Rock Bolts	X		X		Pull adapter, washer, and nut [4]
DYWIDAG Threadbar Anchors	X		X		*GEWI*® coupling, rod, and nut
DYWIDAG GRP Solid Bars	X		X		Pull adapter, washer, and nut [4]
DYWIDAG GRP Hollow Bars and S-D Hollow Bars	X		X	X	DYWI® Drill coupling, hollow bar, and nut [4]
OMEGA-BOLT® Expandable Friction Bolts	X		X		OMEGA-BOLT® pull head, washer, and nut
POWER SET Self-Drilling Friction Bolt	X			X	POWER SET pull testing eqipment
Friction Stabilizers	X		X	X	POWER SET pull testing eqipment
CT-Bolt™ Combination Rock Bolts	X		X		Pull adapter, washer, and nut [4]
Cable Bolt, System Barrel & Wegde	X	X	X	X	See section cable tensione
DYWIDAG Tensionable Strand Anchors	X	X	X	X	See section cable tensione
DYWI® Drill Hollow Bar System	X	X	X	X	DYWI® Drill coupling, hollow bar, and nut

1) Proof force 0 - 320 [kN]: hollow plunger cylinder type RCH-302, proof load: 0 - 640 [kN], hollow plunger cylinder type RCH-603
2) Tripod or bearing cylinder according to hydraulics (320/640)
3) Schematic display. Coupling and pull head, pull rod, washer and nut are adapted to each anchor and rock bolt
4) Recommentation: max. proof force ... $F_{p,0.2}$ of the anchor or rock bolt

Further References

- DSI leaflets on pull tests
- System sketch of test assemblies
- Data sheets and operating procedures

Remarks/Links

- Pull tests must only be carried out in compliance with the present instructions by skilled personnel
- DSI has experienced technical personnel for planning, operation, and analysis of pull tests

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